PATENT

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FOR

QUICK CHANGE GENDER SPECIFIC FORMING SURFACE AND METHOD OF USING SAME

OF

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BACKGROUND OF THE INVENTION

Many types of disposable consumer products such as diapers, training pants, feminine care articles, incontinence articles, and the like, utilize an absorbent pad structure for absorbing and wicking away bodily fluids. The absorbent structures are conventionally formed from an absorbent pad or batt, typically a fibrous material. With one particular general practice, the absorbent web is formed by employing conventional airlaying techniques wherein fibers and typically a superabsorbent material are mixed and entrained in an air stream and then directed onto a forming surface to form the web. The absorbent web may then be directed for further processing and assembly with other components to produce a final absorbent article. An advantage of this practice is that trim waste that may be removed from the absorbent structure can be immediately recycled by returning the waste to the upstream fiberizing equipment and/or airlaying equipment.

With another conventional technique, preformed absorbent web sheets or layers are delivered into a manufacturing line from a preformed supply, such as a supply roll. The absorbent sheet material may be separated into adjacent strips having various configurations of repeat pattern, and/or "nested" shaped pads wherein the shape of one pad is substantially nested with the shape of at least one immediately adjacent pad.

The preformed absorbent material roll process presents particular challenges. For example, the geographical separation of the base roll-making machine makes recycling of the trim waste impractical and cost prohibitive. In this regard, the nesting feature mentioned above has been desirable to reduce the amount of waste that is generated from the originally supplied (roll) of absorbent web. However, with conventional nesting techniques and profiles, a considerable amount of trim waste can still be generated.

Also, the more easily processed strip-shapes have a repeat pattern that is substantially symmetrical with respect to its longitudinal dimension that coincides with the machine direction of the web. With such longitudinally-symmetric nested

patterns, a single cycle of the repeat pattern provides an individual web segment wherein the shape of a first lengthwise half portion of the segment substantially matches the shape of the longitudinally opposed other half portion. However, for certain consumer absorbent articles, it has been found desirable from a product fit, comfort, and performance standpoint to shape the pad so that it is longitudinally asymmetric. For example, the pad may have a wider front or "ear" portion as compared to the back portion. Unfortunately, such configurations in a nested pattern add to the amount of generated waste.

Also, it may be desirable to provide a higher basis weight of absorbent material in the crotch portion as compared to the front and back portions. This has been conventionally done by using a forming surface in an air forming process that contains pockets. The pockets have a depth greater than other portions of the forming surface. Thus, during the air forming process, fibers and absorbent particles collect in the pockets creating greater basis weight areas.

Unfortunately, in certain configurations, the pockets cannot be filled completely without overfilling the non-pocket regions. Consequently, the formed fibrous web has to be scarfed in order to remove absorbent material in the non-pocket regions. Scarfing is a process in which a rotating brush or other suitable device contacts the fibrous material in order to remove unwanted portions. Scarfing, for instance, is described in U.S. Patent No. 6,416,697, which is incorporated herein by reference. The scarfed fibrous material is then returned to the forming chamber and reused.

In addition to having to scarf the final product, use of a pocketed forming surface has also other limitations. For instance, basis weight ratios are limited by the process. Further, scarfing cannot practically be performed when various components are contained in the fibrous material that is used to form the absorbent layer. For instance, scarfing is not well suited for absorbent structures with very high superabsorbent material/fluff ratios or absorbents with components such as meltblown fibers, which may be added in certain situations to improve integrity.

In addition to creating high basis weight areas in absorbent structures, it is also desirable in many applications to change the location of the high basis weight areas depending upon the particular product being made. For instance, it may be

desirable to change the location of the high basis weight area in gender specific products. For example, in products made for girls or for women, it is generally desirable to have a high basis weight area in the crotch area of the garment. In products designed for boys and men, on the other hand, it may be desirable for the high basis weight area to extend from the crotch to the front portion of the product.

One problem involved in the production of gender specific products is in being able to configure a process line that can produce not only absorbent structures intended for male products but also produce absorbent structures intended for female products. In particular, a need currently exists for a process line that can be quickly switched between the production of female specific products and male specific products without having to completely change or reconfigure the forming surface, which may require excessive machine down time.

The present invention provides a method for producing longitudinally symmetric or asymmetric absorbent pad structures in a drum-forming process with minimal or zero waste of the absorbent material. The present invention also provides a method and process of producing absorbent structures having high basis weight areas. Further, through the present invention, the location of the high basis weight areas may be moved and/or altered for creating gender specific products.

SUMMARY OF THE INVENTION

Various features and advantages of the invention will be set forth in part in the following description, or may be obvious from the description, or may be learned through practice of the invention.

The present invention provides an improved system and method for making absorbent structures for use in various applications of consumer disposable absorbent articles, such as disposable diapers, child's training pants, feminine care articles including but not limited to interlabial products, incontinence articles, swim pants, and the like. The structures may be longitudinally symmetric or asymmetric.

In one embodiment of the present invention, for instance, an apparatus is provided for forming an absorbent structure that includes a moving and porous forming surface. A fiber conveying device is positioned to convey fibers onto the forming surface in a gas stream. In accordance with the present invention, at least one masking member is located on the forming surface. The masking member

blocks gas flow through the forming surface. The masking member creates at least two openings in an absorbent fibrous web formed on the forming surface.

In one embodiment, the formed absorbent structure comprises a front portion, a middle portion, a rear portion, and a pair of opposing lateral flaps. The masking member is positioned so as to form the openings between the middle portion and the lateral flaps. The masking member also has a shape such that, when the lateral flaps are folded onto the absorbent web, the middle portion is narrower than the front portion due to the openings.

The masking member may also be shaped so as to form at least one further opening in the rear portion of an absorbent fibrous web formed on the forming surface. The rear opening may be located such that, upon folding of the lateral flaps, the middle portion has a basis weight that is at least about twice the basis weight of areas of the rear portion. In one particular embodiment, the apparatus includes a pair of masking members. Each masking member can have a shape so as to form a middle opening interconnected with a rear opening and each masking member can be positioned so as to form the middle portion between two middle openings and a thin strip of material between two rear openings when an absorbent fibrous web is formed on the forming surface.

The forming surface may be, for instance, a porous fabric. In one embodiment, the forming surface is located on a forming drum. A pattern of masking members may be repeated over the surface of the forming drum for creating a strip of web material defining multiple absorbent pads connected together.

The one or more masking members may include at least one movable tab that can be configured to provide more than one absorbent pattern; for example, the movable tab may enable the masking members to form absorbent structures customized for male and female products, so-called "gender specific absorbent structures". For instance, the tab may be configured to decrease the size of the middle portion of an absorbent fibrous web formed on the forming surface when the tab is placed in an extended position. Alternatively, or in addition to the above, a movable tab may be configured to form at least one front opening located on the front portion of an absorbent fibrous web formed on the forming surface when the tab is placed in an extended position.

The movable tab may be connected to the masking member using any suitable connection device. For instance, in one embodiment, the movable tab is connected to the masking member by a hinge. In an alternative embodiment, the tab is movable between a retracted position and an extended position on the masking member by sliding either over or under the masking member. In still another embodiment, the tab may be completely removable from the masking member.

As described above, the openings formed into the absorbent web and the lateral flaps are used to form greater basis weight areas on the absorbent structure by being folded over other regions of the absorbent structure. The movable tabs may be used to alter the position of the higher basis weight area for producing gender specific products. For instance, in one embodiment, the tabs can be used to locate the higher basis weight areas primarily in the crotch region of an absorbent structure. Alternatively, the tabs may be used to create an absorbent structure in which the higher basis weight area extends from the crotch region to the front portion of the absorbent structure. Of particular advantage, the tabs are easily movable for changing, for instance, from a female specific product to a male specific product.

Once the absorbent structures are produced, they may be incorporated into an absorbent article. For example, in one embodiment, the absorbent structure may be placed in between an outer cover material and a liner for forming, for instance, a diaper, a training pant, an adult incontinence product, or a feminine hygiene product.

In one embodiment, the middle openings may have an inner concave-shaped edge and an outer convex-shaped edge that cooperate when the lateral flaps are folded to give the absorbent structure an overall hourglass-like shape.

The lateral flaps, once folded, may be adhesively secured to the middle portion. In one embodiment, a blank that is used to form the absorbent structure has an overall rectangular shape. In this embodiment, the lateral flaps may extend substantially the entire length of the absorbent structure. Consequently, the lateral flaps fold onto the front portion, the middle portion and the rear portion.

The absorbent structure can be made from any suitable liquid absorbent material. For example, in one embodiment, the absorbent structure may comprise

pulp fibers and superabsorbent particles. The absorbent structure may be airformed, coformed, or made in any other suitable manner. The absorbent structure may have a basis weight of from about 100 grams per square meter (gsm) to about 2000 gsm and may have a density of from about 0.1 grams per cubic centimeter (g/cc) to about 0.45 g/cc.

In accordance with one embodiment of the present invention for making absorbent structures, an absorbent web material is formed using the apparatus described above and supplied in a machine-direction flow in the form of a continuous strip. The strip may include a succession of interconnected individual absorbent pads. Each of the pads may include a front portion, a middle portion, a rear portion, a pair of opposing lateral flaps, a pair of opposing middle openings, and at least one rear opening.

As the absorbent web material is conveyed in the machine direction, the opposing lateral flaps are folded onto at least the middle portion of each individual absorbent pad. The strip of web material is then cut in a cross direction into the individual absorbent pads. Once folded and cut, the middle portion of each pad may have a width narrower than the width of the front portion due to the location of the pair of opposing middle openings. Once folded, the lateral flaps create a basis weight in the location of the middle portion that is at least about twice the basis weight of areas of the rear portion. Similarly, the lateral flaps may also create a basis weight in the location of the front portion that is also at least about twice the basis weight of areas of the rear portion.

The pair of opposing middle openings and the at least one rear opening may be formed by cutting the absorbent web material. Alternatively, the opposing middle openings and the at least one rear opening may be formed during an air forming process in which the strip of web material is formed.

In order to assist in folding the lateral flaps, in one embodiment, the absorbent web material may be scored to form a pair of score lines that generally extend in the machine direction. The score lines define the lateral flaps. The absorbent web material may also be debulked during the process. For example, the absorbent web material may be debulked during formation of the score lines.

The inventions will be described below in greater detail by reference to particular embodiments set forth in the figures.

BRIEF DESCRIPTION OF THE FIGURES

Fig. 1 is a perspective view of a representative absorbent article incorporating an absorbent structure in accordance with the present invention;

Fig. 2 is a perspective view of another embodiment of a representative absorbent article incorporating an absorbent structure in accordance with the present invention;

Fig. 3 is a plan view of the absorbent article as shown in Fig. 2 in an unfolded state;

Fig. 4 is another plan view of an absorbent article;

Fig. 5 is a perspective view of one embodiment of an absorbent structure made in accordance with the present invention;

Fig. 6 is a plan view of the absorbent structure shown in Fig. 5;

Fig. 7 is a plan view of a blank that may be used to form the absorbent structure illustrated in Fig. 5;

Fig. 8 is a plan view of a strip of material showing a succession of blanks as shown in Fig. 7;

Fig. 9 is a perspective view of another embodiment of an absorbent structure made in accordance with the present invention;

Fig. 10 is a plan view of a blank that may be used in forming the absorbent structure illustrated in Fig. 9;

Fig. 11 is a plan view of a strip of web material showing a succession of the blanks illustrated in Fig. 10;

Fig. 12 is a perspective view of a forming surface that may be used in making absorbent structures in accordance with the present invention;

Fig. 13 is a plan view of a forming surface showing masking members that may be used to make absorbent structures in accordance with the present invention;

Fig. 14 is a plan view of an alternative embodiment of a forming surface showing masking members for use in making absorbent structures in accordance with the present invention;

Fig. 15 is a perspective view of one embodiment of a process for forming absorbent structures in accordance with the present invention;

Fig. 16 is a perspective view of one embodiment of a process for forming absorbent articles incorporating the absorbent structures of the present invention;

Fig. 17 is a plan view of another embodiment of a blank that may be used to form absorbent structures in accordance with the present invention;

Fig. 18 is a plan view of an absorbent structure made in accordance with the present invention from the blank shown in Fig. 17; and

Fig. 19 is a perspective view of a forming surface that may be used to form a blank as shown in Fig. 17.

DETAILED DESCRIPTION

The invention will now be described in detail with reference to particular embodiments thereof. The embodiments are provided by way of explanation of the invention, and not meant as a limitation of the invention. For example, features described or illustrated as part of one embodiment may be used with another embodiment to yield still a further embodiment. It is intended that the present invention include these and other modifications and variations as come within the scope and spirit of the invention.

The present method is particularly suited for the manufacture of pad structures from a web of absorbent material. The pads are intended for use in various consumer disposable absorbent products. Such products include, but are not limited to, diapers, children's training pants, feminine care articles (such as panty liners, pads, and interlabial products), incontinence articles, swim pants, and the like. The invention is not limited to any particular type or composition of absorbent web material, and may be practiced with any suitable absorbent web material known to those skilled in the art. The absorbent web material may include any structure and combination of components which are generally compressible, conformable, non-irritating to a wearer's skin, and capable of absorbing and retaining liquids and certain body wastes.

The absorbent pad structures of the present invention include higher basis weight areas in desired locations. For instance, the higher basis weight areas may be formed into the crotch area of an absorbent article. The higher basis weight areas may also extend from the crotch area into a front portion of the absorbent article. In accordance with the present invention, the absorbent pads contain openings and lateral flaps that are folded during formation of the absorbent

structures. Through the use of openings having particular shapes and through the use of lateral flaps, the higher basis weight areas may be formed into the absorbent structures without, in one embodiment, creating any waste. In accordance with the present invention, the shape and location of the openings may be varied for creating gender specific products.

The material used to form the absorbent structures, for example, may include cellulosic fibers (e.g., wood pulp fibers), other natural fibers, synthetic fibers, woven or nonwoven sheets, scrim netting or other stabilizing structures, superabsorbent material, binder materials, surfactants, selected hydrophobic materials, pigments, lotions, odor control agents or the like, as well as combinations thereof. In a particular embodiment, the absorbent web material is a matrix of cellulosic fluff and superabsorbent hydrogel-forming particles. The cellulosic fluff may comprise a blend of wood pulp fluff. One preferred type of fluff is identified with the trade designation CR 1654, available from US Alliance Pulp Mills of Coosa, Alabama, USA, and is a bleached, highly absorbent wood pulp containing primarily soft wood fibers. As a general rule, the superabsorbent material is present in the absorbent web in an amount of from about 0 to about 90 weight percent based on total weight of the web. The web may have a density within the range of about 0.1 to about 0.45 grams per cubic centimeter.

Superabsorbent materials are well known in the art and can be selected from natural, synthetic, and modified natural polymers and materials. The superabsorbent materials can be inorganic materials, such as silica gels, or organic compounds, such as crosslinked polymers. Typically, a suberabsorbent material is capable of absorbing at least about 15 times its weight in liquid, and suitably is capable of absorbing more than about 25 times its weight in liquid. Suitable superabsorbent materials are readily available from various suppliers. For example, FAVOR SXM 880 superabsorbent is available from Stockhausen, Inc., of Greensboro, North Carolina, USA; and Drytech 2035 is available from Dow Chemical Company, of Midland, Michigan, USA.

In addition to cellulosic fibers and superabsorbent materials, the absorbent pad structures may also contain adhesive elements and/or synthetic fibers that provide stabilization and attachment when appropriately activated. Additives such as adhesives may be of the same or different aspect from the cellulosic fibers; for

example, such additives may be fibrous, particulate, or in liquid form; adhesives may possess either a curable or a heat-set property. Such additives can enhance the integrity of the bulk absorbent structure, and alternatively or additionally may provide adherence between facing layers of the folded structure.

Subsequent to or after being cut from the web material strip, the individual absorbent pads may be partially or wholly wrapped or encompassed by a suitable tissue or nonwoven wrap that aids in maintaining the integrity and shape of the pad.

The absorbent materials may be formed into a web structure by employing various conventional methods and techniques. For example, the absorbent web may be formed with a dry-forming technique, an airlaying technique, a carding technique, a meltblown or spunbond technique, a wet-forming technique, a foam-forming technique, or the like, as well as combinations thereof. Layered and/or laminated structures may also be suitable. Methods and apparatus for carrying out such techniques are well known in the art.

The absorbent web material may also be a coform material. The term "coform material" generally refers to composite materials comprising a mixture or stabilized matrix of thermoplastic fibers and a second non-thermoplastic material. As an example, coform materials may be made by a process in which at least one meltblown die head is arranged near a chute through which other materials are added to the web while it is forming. Such other materials may include, but are not limited to, fibrous organic materials such as woody or non-woody pulp such as cotton, rayon, recycled paper, pulp fluff and also superabsorbent particles or fibers, inorganic absorbent materials, treated polymeric staple fibers and the like. Any of a variety of synthetic polymers may be utilized as the melt-spun component of the coform material. For instance, in some embodiments, thermoplastic polymers can be utilized. Some examples of suitable thermoplastics that can be utilized include polyolefins, such as polyethylene, polypropylene, polybutylene and the like; polyamides; and polyesters. In one embodiment, the thermoplastic polymer is polypropylene. Some examples of such coform materials are disclosed in U.S. Patent Nos. 4,100,324 to Anderson, et al.; 5,284,703 to Everhart, et al.; and 5,350,624 to Georger, et al.; which are incorporated herein in their entirety by reference for all purposes.

It is also contemplated that elastomeric absorbent web structures may be particularly well suited to the present invention. For example, an elastomeric coform absorbent structure having from about 35% to about 65% by weight of a wettable staple fiber, and greater than about 35% to about 65% by weight of an elastomeric thermoplastic fiber may be used to define absorbent pad structures according to the invention. Examples of such elastomeric coform materials are provided in U.S. Pat. No. 5,645,542, incorporated herein in its entirety for all purposes. As another example, a suitable absorbent elastic nonwoven material may include a matrix of thermoplastic elastomeric nonwoven filaments present in an amount of about 3 to less than about 20% by weight of the material, with the matrix including a plurality of absorbent fibers and a super-absorbent material each constituting about 20-77% by weight of the material. U.S. Pat. No. 6,362,389 describes such a nonwoven material and is incorporated herein by reference in its entirety for all purposes. Absorbent elastic nonwoven materials are useful in a wide variety of personal care articles where softness and conformability, as well as absorbency and elasticity, are important.

The absorbent web may also be a nonwoven web comprising synthetic fibers. The web may include additional natural fibers and/or superabsorbent material. The web may have a density in the range of about 0.1 to about 0.45 grams per cubic centimeter. The absorbent web can alternatively be a foam.

In a particular aspect of the invention, the absorbent web material can be provided with an absorbent capacity of at least about 8 g/g employing 0.9 wt% saline (8 grams of 0.9 wt% saline per gram of absorbent web). The absorbent capacity of the absorbent web can alternatively be at least about 9 g/g, and can optionally be at least about 15 g/g to provide improved benefits. Additionally, the absorbent capacity may be up to about 40 g/g, or more, to provide desired performance.

In another aspect, the web of absorbent material can be provided with a tensile strength value of at least about 0.5 N/cm (Newtons per cm of "width" of the material, where the "width" direction is perpendicular to the applied force). The tensile strength of the absorbent web can alternatively be at least about 1.5 N/cm, and can optionally be at least about 2 N/cm to provide improved benefits. In another aspect, the web of absorbent material can be provided with a tensile

strength value of up to a maximum of about 100 N/cm, or more. The tensile strength of the absorbent web can alternatively be up to about 10 N/cm, and can optionally be up to about 20 N/cm to provide improved benefits.

The selected tensile strength should provide adequate processibility of the web throughout the manufacturing process, and can help to produce articles that exhibit desired combinations of softness and flexibility. In particular, the absorbent web material should have a tensile strength in the cross-direction to undergo stretching as described herein without resulting in substantial degradation of the web integrity to the extent that the pad structures cannot be further processed in absorbent articles. In some cases, the stretching of the web material in the cross direction can provide a softer and more flexible material than the initial web. This is generally desired for initially stiff materials such as some stabilized airlaid or wetlaid materials.

The absorbent material web is also selected so that the individual absorbent pad structures possess a particular individual total absorbency depending on the intended article of use. For example, for infant care products, the total absorbency can be within the range of about 200-900 grams of 0.9 wt% saline, and can typically be about 500g of 0.9 wt% saline. For adult care products, the total absorbency can be within the range of about 400-2000 grams of 0.9 wt% saline, and can typically be about 1300g of saline. For feminine care products, the total absorbency can be within the range of about 7-50 grams of menstrual fluid or menses simulant, and can typically be within the range of about 30-40 g of menstrual fluid or menses simulant.

Referring now to Figs. 5 and 9, two embodiments of absorbent structures made in accordance with the present invention are illustrated. For instance, referring to Fig. 5, an absorbent structure generally **10** is shown. A top plan view of the absorbent structure **10** is also shown in Fig. 6. The absorbent structure **10** includes a front portion **12**, a middle portion **14**, and a rear portion **16**. When incorporated into an absorbent product, the middle portion **14** is positioned generally in the crotch area of the garment, while the front portion **12** is positioned adjacent to the front of a wearer.

Referring to Fig. 7, a blank generally **20** is shown that may be used to form the absorbent structure **10** as shown in Figs. 5 and 6. As shown, the blank **20** has

a generally rectangular shape and includes score lines **22** and **24**. The blank **20** includes a pair of opposing middle openings **26** and **28** and a pair of opposing rear openings **30** and **32**. As shown, the middle portion **14** is positioned in between the middle openings **26** and **28**. In this embodiment, the rear openings **30** and **32** are interconnected and continuous with the middle openings **26** and **28**. In other embodiments, however, the rear openings **30** and **32** may be separate from the middle openings **26** and **28**. Further, in other embodiments, only a single rear opening may be needed.

The rear openings **30** and **32** of the blank **20** shown in Fig. 7 are also separated by a thin strip of material **33**. The thin strip of material **33** is for providing integrity to the blank **20** when part of a continuous roll or strip of material.

Each middle opening **26** and **28** includes an arcuate-shaped edge **34** and a corresponding arcuated-shaped edge **36**, which extends in an opposite direction. As shown, the score lines **22** and **24** separate the arcuate-shaped edges.

The score lines **22** and **24** also define a pair of opposing lateral flaps **38** and **40**. In order to convert the blank **20** as shown in Fig. 7 into the absorbent structure **10** as shown in Figs. 5 and 6, the lateral flaps 38 and 40 are folded over onto the front portion 12, the middle portion 14, and the rear portion 16. As shown in Figs. 5 and 6, when the lateral flaps 38 and 40 are folded, the middle openings **26** and **28** provide the absorbent structure **10** with an overall hourglass-like shape. Further, the folded lateral flaps in conjunction with the rear openings create basis weight differentials over the length of the absorbent structure **10**.

For example, as shown in Fig. 5, once the lateral flaps **38** and **40** are folded, the front portion **12** and the middle portion **14** comprise two layers of material, while the rear portion **16** comprises primarily only a single layer of material. Thus, when the absorbent is formed to have a substantially uniform basis weight at all locations before folding, the front portion **12** and the middle portion **14** can have a basis weight that is at least about twice the basis weight of the rear portion **16** after folding. In other embodiments, however, the blank **20** may be formed so as to have basis weight differentials. For example, the lateral flaps may have a basis weight greater than the basis weight of the front portion, the middle portion or the rear portion. In other embodiments, for instance, the middle portion may have a basis weight greater than the lateral flaps, the front portion or the rear portion.

Generally, once the lateral flaps **38** and **40** are folded, the front portion **12** and the middle portion **14** may have a basis weight, for instance, that is at least 25% greater than the basis weight of the rear portion **16**, particularly at least 50% greater, and more particularly at least 100% greater.

In the embodiment shown in Fig. 5, the lateral flaps **38** and **40** have a width that is approximately one half the width of the middle portion **14**. In other embodiments, however, the width of the lateral flaps **38** and **40** may be varied in order to vary the product dimensions and characteristics. For example, in one embodiment, the lateral flaps may have a width that is from about 25% to about 50% of the width of the middle portion **14**. In this embodiment, when the lateral flaps are folded, the lateral flaps do not contact each other but, instead, create a channel in the middle portion of the absorbent structure. The channel may be used, for instance, to improve fluid handling characteristics. For instance, the channel may be used to collect fluids prior to the fluids being absorbed by the absorbent material.

In other embodiments, the lateral flaps **38** and **40** may have a width that is greater than 50% of the width of the middle portion, such as having a width from about 50% to 100% of the width of the middle portion **14**. In this embodiment, once the lateral flaps **38** and **40** are folded, the flaps overlap to form a three layer structure. Creating a three layer structure further increases the basis weight of the middle portion **14**.

In other embodiments, the blank **20** may be made with a non-rectangular shape that would create other basis weight differentials.

Although the absorbent structure **10** as shown in Fig. 5 may be used in any suitable absorbent product, the absorbent structure **10** is particularly well suited for use in male specific products. In particular, the absorbent structure **10** includes greater liquid absorbent areas in the middle portion and in the front portion where typically needed for a male wearer. Referring to Figs. 9 and 10, on the other hand, a female specific absorbent structure generally **50** is shown. In Figs. 9 and 10, like reference numerals have been included in order to identify similar features or areas of the absorbent structure **50**.

Referring to Fig. 10, a blank generally **51** is illustrated that may be used to construct the absorbent structure **50** as shown in Fig. 9. In comparison to the

blank **20** as shown in Fig. 7, in this embodiment, the blank **51** includes a longer middle portion **14** and includes a pair of opposing front openings **52** and **54**.

Referring to Fig. 9, when the lateral flaps **38** and **40** are folded in this embodiment, the higher basis weight area is generally shifted towards the rear portion **16** due to the elongation of the middle portion **14** and the presence of the front openings **52** and **54**. For example, as shown, the absorbent structure **50** includes a front portion **12**, a middle portion **14**, and a rear portion **16**. When the lateral flaps **38** and **40** are folded, the front openings **52** and **54** are shown located at the uppermost location of the front portion **12**. Thus, the absorbent structure **50** includes a primarily single layer area in the front portion and in the rear portion and a two-layer area in the middle portion **14** and extending partly into the front portion **12**. By shifting the higher basis weight areas as shown in Fig. 9, the absorbent structure **50** is better suited for use in absorbent products that are female specific. The overall shape of the absorbent structure **50**, however, is substantially the same as the overall shape of the absorbent structure **10** as shown in Fig. 5.

As described above, in other embodiments, the lateral flaps **38** and **40** as shown in Fig. 9 may have a width that is from about 25% to 100% of the width of the middle portion **14**. When having a width that is less than 50% of the width of the middle portion, a fluid handling channel forms in the absorbent structure **10**. When the lateral flaps have a width that is greater than 50% of the width of the middle portion **14**, on the other hand, the lateral flaps overlap and a three layer structure is formed.

As will be described in more detail below, the absorbent structures of the present invention can be constructed from a single layer of material that generally has a uniform basis weight. Through the use of the openings and by folding the lateral flaps, however, basis weight differentials within the product can be formed without creating a substantial amount of trim waste. In fact, in one embodiment, zero trim waste may be produced when forming the absorbent structures. Of particular advantage, gender specific absorbent structures can also be produced by making small changes in the manufacturing process.

The absorbent structures **10** and **50** as shown in Figs. 5 and 9 may be incorporated into any suitable absorbent article, such as a diaper, a training pant, an adult incontinence product, a feminine hygiene product, and the like. For

example, referring to Figs. 1-4, a pant-like absorbent article generally **60** is illustrated. The article **60** includes a chassis **62** defining a front region **64**, a back region **66**, and a crotch region **68** interconnecting the front and back regions. The chassis **62** includes a bodyside liner **70** which is configured to contact the wearer, and an outer cover **72** opposite the bodyside liner which is configured to contact the wearer's clothing. An absorbent structure **74** (see Fig. 4) is positioned or located between the outer cover **72** and the bodyside liner **70**. The absorbent structure **74** is made in accordance with the present invention and may be, for instance, an absorbent structure as illustrated in Fig. 5 or an absorbent structure as illustrated in Fig. 9.

Fig. 2 illustrates an alternative embodiment of an absorbent article **60** similar to the absorbent article illustrated in Fig. 1. Like reference numerals have been used to indicate similar elements. As shown, the absorbent article **60** shown in Fig. 2, different than the embodiment shown in Fig. 1, includes refastenable sides. The absorbent article **60** shown in Fig. 1, on the other hand, has permanently bonded sides. Both embodiments of an absorbent article define a 3-dimensional pant configuration having a waist opening **76** and a pair of leg openings **78**. The front region **64** includes the portion of the article **60** which, when worn, is positioned on the front of the wearer while the back region **66** includes the portion of the article which, when worn, is positioned on the back of the wearer. The crotch region **68** of the absorbent article **60** includes the portion of the article which, when worn, is positioned between the legs of the wearer and covers the lower torso of the wearer.

As shown in further detail in Figs. 1-4, the chassis **62** also defines a pair of longitudinally opposed waist edges which are designated front waist edge **80** and back waist edge **82**. The front region **64** is contiguous with the front waist edge **80**, and the back region **66** is contiguous with the back waist edge **82**. The waist edges **80**, **82** are configured to encircle the waist of the wearer when worn and define the waist opening **76**. For reference, arrows **84** and **86** depicting the orientation of the longitudinal axis and the transverse axis, respectively, of the absorbent article **60** are illustrated in Figs. 3 and 4.

The illustrated absorbent chassis **62** includes a pair of transversely opposed front side panels **88**, and a pair of transversely opposed back side panels **90**. The

side panels **88**, **90** may be integrally formed with the outer cover **72** and/or the bodyside liner **70** or may include two or more separate elements.

The side panels **88** and **90** suitably include an elastic material capable of stretching in a direction generally parallel to the transverse axis **86** of the absorbent article **60**. Suitable elastic materials, as well as processes of incorporating side panels into a training pant, are known to those skilled in the art, and are described, for example, in U.S. Patent No. 4,940,464 issued July 10, 1990 to Van Gompel et al., which is incorporated herein by reference.

As mentioned, the absorbent article **60** according to the present invention may be refastenable, thereby including a fastening system **92** for securing the training pant above the waist of the wearer (see Fig. 2). The illustrated fastening system **92** may include fastening components **94** that are adapted to refastenably connect to mating fastening components **96**. In one embodiment, one surface of each of the fastening components **94** and **96** includes a plurality of engaging elements that project from that surface. The engaging elements of these fastening components **94** are adapted to repeatedly engage and disengage the engaging elements of the mating fastening components **96**.

In one particular embodiment, the fastening components **94** each include hook type fasteners and the mating fastening components **96** each include complementary loop type fasteners. In another particular embodiment, the fastening components **94** each include loop type fasteners and the mating fastening components **96** each include complementary hook type fasteners.

As noted previously, the illustrated absorbent article **60** has front and back side panels **88** and **90** disposed on each side of the absorbent chassis **62**. These transversely opposed front side panels **88** and transversely opposed back side panels **90** can be permanently bonded to the composite structure comprising the absorbent chassis **62** in the respective front and back regions **64** and **66**. Additionally, the side panels **88** and **90** can be permanently bonded to one another using suitable bonding means, such as adhesive bonds or ultrasonic bonds, to provide a non-fastenable absorbent article **60** (Fig. 1). Alternatively, the side panels **88** and **90** can be releaseably attached to one another by a fastening system **92** as described above. More particularly, as shown best in Fig. 3, the front side panels **88** can be permanently bonded to and extend transversely

beyond the linear side edges **98** of the composite structure in the front region **64** along attachment lines **100**, and the back side panels **90** can be permanently bonded to and extend transversely beyond the linear side edges **98** of the composite structure in the back region **66** along attachment lines **100**. The side panels **88** and **90** may be attached using attachment means known to those skilled in the art such as adhesive, thermal or ultrasonic bonding. The side panels **88** and **90** can also be formed as a portion of a component of the composite structure, such as the outer cover **72** and/or the bodyside liner **70**.

Each of the side panels **88** and **90** can include one or more individual, distinct pieces of material. In particular embodiments, for example, each side panel **88** and **90** can include first and second side panel portions that are joined at a seam, with at least one of the portions including an elastomeric material. Still alternatively, each individual side panel **88** and **90** can include a single piece of material which is folded over upon itself along an intermediate fold line (not shown). Suitably, the side panels **88** and **90** include an elastic material capable of stretching in a direction generally parallel to the transverse axis **86** of the absorbent article **60**.

To enhance containment and/or absorption of body exudates, the absorbent article **60** may include a front waist elastic member **102**, a rear waist elastic member **104**, and leg elastic members **106**, as are all known to those skilled in the art (see Fig. 4). The waist elastic members **102** and **104** can be operatively joined to the outer cover **72** and/or the bodyside liner **70** along the opposite waist edges **80** and **82**, and can extend over part or all of the waist edges. The leg elastic members **106** are suitably operatively joined to the outer cover **72** and/or bodyside liner **70** along opposite side edges of the chassis **62** and positioned in the crotch region **68** of the absorbent article **60**.

The waist elastic members **102**, **104** and the leg elastic members **106** can be formed of any suitable elastic material. As is well known to those skilled in the art, suitable elastic materials include sheets, strands or ribbons of natural rubber, synthetic rubber, or thermoplastic elastomeric polymers. The elastic materials can be stretched and attached to a substrate, attached to a gathered substrate, or attached to a substrate and then elasticized or shrunk, for example with the application of heat; such that elastic constrictive forces are imparted to the

substrate. In one particular embodiment, for example, the leg elastic members **106** include a plurality of dry-spun coalesced multifilament spandex elastomeric threads sold under the trade name LYCRA and available from E.I. DuPont de Nemours and Co., Wilmington, DE.

To enhance containment and/or absorption of any body exudates discharged from the wearer, the chassis **62** may include a pair of containment flaps **108** which are configured to provide a barrier to the transverse flow of body exudates. A flap elastic member **110** (see Fig. 4) may be operatively joined with each containment flap **108** in any suitable manner as is well known in the art. The elasticized containment flaps **108** define an unattached edge which assumes an upright, generally perpendicular configuration in at least the crotch region **68** of the absorbent article **60** to form a seal against the wearer's body. The containment flaps **108** can be located along the transversely opposed side edges of the chassis **62**, and can extend longitudinally along the entire length of the chassis or may only extend partially along the length of the chassis. Suitable constructions and arrangements for the containment flaps **108** are generally well known to those skilled in the art.

The absorbent articles **60** as shown in Figs. 1-4 can be made from various materials. The outer cover **72** may be made from a material that is substantially liquid and permeable, and can be elastic, stretchable or nonstretchable. The outer cover **72** can be a single layer of liquid and permeable material, or may include a multi-layered laminate structure in which at least one of the layers is liquid and permeable. For instance, the outer cover **72** can include a liquid permeable outer layer and a liquid and permeable inner layer that are suitably joined together by a laminate adhesive.

For example, in one embodiment, the liquid permeable outer layer may be a spunbond polypropylene nonwoven web. The spunbond web may have, for instance, a basis weight of from about 15 gsm to about 25 gsm.

The inner layer, on the other hand, can be both liquid and vapor impermeable, or can be liquid impermeable and vapor permeable. The inner layer is suitably manufactured from a thin plastic film, although other flexible liquid impermeable materials may also be used. The inner layer prevents waste material from wetting articles such as bedsheets and clothing, as well as the wearer and

caregiver. A suitable liquid impermeable film may be a polyethylene film having a thickness of about 0.2 mm.

A suitable breathable material that may be used as the inner layer is a microporous polymer film or a nonwoven fabric that has been coated or otherwise treated to impart a desired level of liquid impermeability. Other "non-breathable" elastic films that may be used as the inner layer include films made from block copolymers, such as styrene-ethylene-butylene-styrene or styrene-isoprene-styrene block copolymers.

As described above, the absorbent structure is positioned in between the outer cover and a liquid permeable bodyside liner **70**. The bodyside liner **70** is suitably compliant, soft feeling, and non-irritating to the wearer's skin. The bodyside liner **70** can be manufactured from a wide variety of web materials, such as synthetic fibers, natural fibers, a combination of natural and synthetic fibers, porous foams, reticulated foams, apertured plastic films, or the like. Various woven and nonwoven fabrics can be used for the bodyside liner **70**. For example, the bodyside liner can be made from a meltblown or spunbonded web of polyolefin fibers. The bodyside liner can also be a bonded-carded web composed of natural and/or synthetic fibers.

A suitable liquid permeable bodyside liner **70** is a nonwoven bicomponent web having a basis weight of about 27 gsm. The nonwoven bicomponent can be a spunbond bicomponent web, or a bonded carded bicomponent web. Suitable bicomponent staple fibers include a polyethylene/polypropylene bicomponent fiber. In this particular embodiment, the polypropylene forms the core and the polyethylene forms the sheath of the fiber. Other fiber orientations, however, are possible.

One embodiment of a process for forming absorbent structures in accordance with the present invention will now be described with particular reference to Figs. 13, 14 and 15. As described above, the absorbent structures may be formed according to various different processes. Referring to Fig. 15, one embodiment of an air forming process generally **120** in accordance with the present invention is shown. The air forming process **120** as shown in Fig. 15 is generally referred to also as a drum forming process. As shown, the system includes a forming drum **122** as particularly illustrated in Fig. 12. The forming

drum **122** includes a porous forming surface **124**. As shown, the forming surface **124** may comprise a screen. Secured to the forming surface **124** are a pair of masking members **126** and **128** in accordance with the present invention. The masking members **126** and **128** cause the middle openings and the rear openings to be formed in an absorbent web.

The masking members **126** and **128** are more particularly shown in Fig. 13 secured to the forming surface **124**. As shown particularly in Fig. 13, vertical masking strips **130** and **132** may also be secured to the forming surface. The vertical masking strips **130** and **132** are for adjusting the width of the absorbent web that is formed.

As shown in Fig. 15, in order to form an absorbent web, a selected fibrous material **121** can be introduced into the system as air-entrained fibers in a stream flowing in the direction toward the forming surface **124**. The fibers may suitably be derived from a batt of cellulosic fibers (e.g., wood pulp fibers) or other source of natural or synthetic fibers, which has been subjected to a fiberization treatment, in a manner well known in the art, to provide an operative quantity of individual, loose fibers. For example, a hammer mill or other conventional fiberizer may be employed. Particles or fibers of superabsorbent material may also be introduced into a forming chamber **134** by employing conventional mechanisms, such as pipes, channels, spreaders, nozzles and the like, as well as combinations thereof. The fibers and particles may be entrained in any suitable gaseous medium, and references herein to air as being the entraining medium should be understood to be a general reference which encompasses any other operative entrainment gas.

The stream of air-entrained fibers and particles can pass through the forming chamber **134** and onto the forming surface **124** of the forming drum **122**. The forming chamber can serve to direct and concentrate the air-entrained fibers and particles, and to provide a desired velocity profile in the air-entrained stream of fibers and particles. The forming chamber is typically supported by suitable structural members, which together form a support frame for the forming chamber.

As shown, the forming drum **122** is rotatable in a selected direction of rotation, and can be rotated by employing a drum drive shaft that is operatively joined to any suitable drive mechanism (not shown). For example, the drive mechanism can include an electric or other motor which is directly or indirectly

coupled to the drive shaft. While the shown arrangement provides a forming drum that is arranged to rotate in a counter-clockwise direction, it should be readily apparent that the forming drum may alternatively be arranged to rotate in a clockwise direction.

The forming drum **122** can provide a laydown zone **136** which is positioned within the forming chamber **134** and provides a vacuum laydown zone of the foraminous forming surface **124**. This vacuum laydown zone constitutes a circumferential, cylindrical surface portion of the rotatable drum **122**. An operative pressure differential is imposed on the surface of the vacuum laydown zone under the action of a conventional vacuum generating mechanism, such as a vacuum pump, an exhaust blower or other suitable mechanism which can provide a relatively lower pressure under the forming surface **124**. The vacuum mechanism can operatively withdraw air from the arcuate segment of the forming drum associated with the vacuum laydown surface through an air discharge duct **138**.

As shown, the foraminous forming surface **124** can include a series of forming sections which are distributed circumferentially along the periphery of the forming drum **122**. The succession of forming sections can provide a selected repeat pattern that is formed into a fibrous web. For example, as shown, four sets of masking members **126** and **128** are shown around the circumference of the forming drum **122**.

Suitable forming drum systems for producing air laid fibrous webs are known. For example, U.S. Patent No. 4,666,647, U.S. Patent No. 4,761,258, U.S. Patent No. 6,330,735, and U.S. Patent No. 4,927,582 all disclose air forming processes and all are incorporated herein by reference.

Thus, under the influence of a vacuum mechanism, a conveying air stream is drawn through the foraminous forming surface **124** into the interior of the forming drum **122**, and is subsequently passed out of the drum through the discharge duct **138**. As the air entrained fibers and particles impinge on the forming surface **124**, the air component thereof is passed through the forming surface and the fibers-particles component is retained on the forming surface to form a commingled fibrous web or pad **140** thereon. In accordance with the present invention, the masking members **126** and **128** prevent the formation of a web on the forming surface **124** where they are located. Thus, through the use of the masking

members **126** and **128**, openings are formed in the web at particular locations for forming absorbent structures in accordance with the present invention.

Subsequently, with the rotation of the drum **122**, the formed web **140** can be removed from the forming surface **124** by the weight of the web, by centrifugal force, and by a positive pressure produced, for example, by a pressurized air flow through a blow off zone **142**. The pressurized air can exert a force directed outwardly through the forming surface.

As shown in Fig. 15, a continuous strip of the fibrous web **140** is produced and is conveyed by a conveyor **144** in a machine direction. A top plan view of the strip of absorbent web material **140** that is formed is shown in Fig. 8. As illustrated, a series or succession of blanks **20** as shown in Fig. 8 are produced by the drum forming apparatus. Each blank includes a front portion **12**, a middle portion **14**, and a rear portion **16**. Further, the masking members **126** and **128** also form the middle openings **26** and **28** and the rear openings **30** and **32**. As particularly shown in Fig. 8, the thin strip of material **33** separating the rear openings **30** and **32** provides integrity to the continuous strip of material as the material is moved and processed.

Referring back to Fig. 15, the produced strip of web material **140** is then fed to a scoring and debulking apparatus **146**. The scoring and debulking apparatus **146** comprises a roll that includes raised portions that form the scoring lines **22** and **24**. The apparatus **146** also debulks at least portions of the web. For example, in one embodiment, the apparatus compresses and densifies the lateral flaps.

From the scoring and debulking apparatus **146**, the absorbent web of material **140** is then fed to a folding device **148** which folds the lateral flaps along the scoring lines **22** and **24**. Next, the web of material **140** is fed to a cutting device **150**. The cutting device **150** cuts the material **140** in the cross-machine direction in order to form individual absorbent structures for incorporation into various absorbent products.

As described above, the masking members **126** and **128** as shown in Fig. 13 may be used to produce an absorbent structure **10** as shown in Fig. 5. The absorbent structure **10** is particularly well suited for use in male specific products. One of the advantages of the process and system of the present invention is the

ability to easily switch from the production of a male specific product to a female specific product and vice versa. In this regard, as shown in Fig. 13, each of the masking members **126** and **128** can include a movable middle tab **152** and a movable rear tab **154** (shown in phantom). The middle tabs **152** and the rear tabs **154** may be movable on the masking members as shown in Fig. 13 or, alternatively, may be easily removed altogether from the masking members. Further, although the middle tabs **152** and the rear tabs **154** are shown in a 2-piece construction, it should be understood that the masking members can include a single middle tab **152** and a single rear tab **154**.

As described above, when changing from a male specific absorbent structure to a female specific absorbent structure, it is generally desirable to move the higher basis weight area more towards the middle and rear of the absorbent structure. According to the present invention, the middle tabs **152** and the rear tabs **154** allow for shifting of the higher basis weight area when forming absorbent structures. For example, referring to Fig. 14, the forming surface **124** is shown in which the masking members **126** and **128** have been converted in order to form female specific absorbent structures. As shown, the middle tabs **152** as illustrated in Fig. 13 have been retracted within each masking member **126** and **128**. Alternatively, as described above, the middle tabs **152** may also be completely removed from each masking member.

As also shown, the rear tabs **154** have been placed in an extended position. As shown in Figs. 10 and 14, the rear tabs **154** actually produce the front openings **52** and **54** in an absorbent structure made with the forming surface **124**.

Any suitable device or mechanism may be used in order to retract and extend the middle tabs **152** and the rear tabs **154**. For example, the tabs may slide below or over top of each masking member **126** and **128** when it is desired either to hide the tabs or extend the tabs. In this embodiment, the tabs may be removably tightened against each masking member using, for instance, a suitable bolt or screw. By loosening the bolt or screw, the tabs **152** and **154** may be easily slid into an extended position or a retracted position.

Alternatively, the tabs **152** and **154** may be attached to the masking members **126** and **128** with hinges. In this manner, the tabs **152** and **154** may swing or pivot between a retracted position and an extended position. It should be

understood, however, that various other means and mechanisms may be used in order to retract or extend the tabs. Also, as stated above, the tabs may be completely removable from the masking members.

As shown in Fig. 14, by retracting the middle tabs **152** and extending the rear tabs **154** a blank **51** may be produced as shown in Fig. 10 for forming the absorbent structure **50** as shown in Fig. 9. By retracting the tabs **152** and extending the tabs **154**, the higher basis weight area is shifted from the front towards the middle portion of the absorbent pad. When located on a forming drum in a repeating pattern, the masking members as shown in Fig. 14 may be used to form a continuous strip of absorbent material **156** as shown in Fig. 11.

Referring now to Fig. 16, an exemplary embodiment of an assembly section **220** for making a continuous stream of partially assembled, discrete pants or garments **60** is illustrated. The specific equipment and processes used in the assembly section **220** can vary greatly depending on the specific type of garment being manufactured. The particular process and apparatus described in relation to Fig. 16 is specifically adapted to manufacture absorbent articles **60** of the type illustrated in Figs. 1 through 4.

The various components of the garment **60** can be connected together by any means known to those skilled in the art such as, for example, adhesive, thermal and/or ultrasonic bonds. Suitably, most of the components are connected using ultrasonic bonding for improved manufacturing efficiency and reduced raw material costs. Certain garment manufacturing equipment which is readily known and understood in the art, including frames and mounting structures, ultrasonic and adhesive bonding devices, transport conveyors, transfer rolls, guide rolls, tension rolls, and the like, have not been shown in Fig. 16.

A continuous supply of material **222** used to form the bodyside liner **70** is provided from a supply source **224**. The supply source **224** can include for example a pair of spindles, a festoon assembly, and optionally a dancer roll (not shown) for providing bodyside liner material **222** at a desired speed and tension.

Various components can be disposed on and/or bonded to the bodyside liner material **222** as the material travels in a machine direction identified by arrow **226**. In particular, a surge layer can be provided at an application station **228** and

disposed on and/or bonded to the bodyside liner material **222**. The surge layer can include either a continuous web or discrete sheets.

Surge layers are generally well known in the art as being constructed to quickly collect and temporarily hold liquid surges, and to transport the temporarily held liquid to the absorbent structure **10**.

Various woven and non-woven fabrics can be used to construct the surge layer. For example, the surge layer may be a layer made of a meltblown or spunbond web of synthetic fibers, such as polyolefin fibers. The surge layer may also be a bonded-carded-web or an airlaid web composed of natural and synthetic fibers. The bonded-carded-web may, for example, be a thermally bonded web that is bonded using low melt binder fibers, powder or adhesive. The webs can optionally include a mixture of different fibers. The surge layer may be composed of a substantially hydrophobic material, and the hydrophobic material may optionally be treated with a surfactant or otherwise processed to impart a desired level of wettability and hydrophilicity.

Examples of materials suitable for the surge layer are set forth in U.S. Patent No. 5,486,166 issued January 23, 1996 in the name of C. Ellis et al. and entitled "FIBROUS NONWOVEN WEB SURGE LAYER FOR PERSONAL CARE ABSORBENT ARTICLES AND THE LIKE"; U.S. Patent No. 5,490,846 issued February 13, 1996 in the name of Ellis et al. and entitled 'IMPROVED SURGE MANAGEMENT FIBROUS NONWOVEN WEB FOR PERSONAL CARE ABSORBENT ARTICLES AND THE LIKE"; and U.S. Patent No. 5,364,382 issued November 15, 1994 in the name of Latimer et al. and entitled "ABSORBENT STRUCTURE HAVING IMPROVED FLUID SURGE MANAGEMENT AND PRODUCT INCORPORATING SAME", the disclosures of which are hereby incorporated by reference in a manner consistent with the present document.

Additionally, a containment flap module **230** can be provided downstream of the supply source **224** for attaching pre-assembled containment flaps to the bodyside liner material **222**. The containment flaps are located generally adjacent to the side edges of the garment assembly **60**, and can extend longitudinally along the entire length of the garment assembly **60** or only partially along the length of the garment assembly. Suitable constructions and arrangements for the containment flaps are generally well known to those skilled in the art and are

described in U.S. Patent 4,704,116 issued November 3, 1987 to Enloe, which is incorporated herein by reference.

As various components are added in the assembly section **220**, a continuously moving product assemblage **232** is formed. The product assemblage **232** will be cut downstream to form the partially assembled, discrete garments **60**.

A plurality of absorbent structures **10** are provided from a suitable supply source. The supply source can be, for instance, the air forming system and process as shown in Fig. 15.

Assembly section **220** can include a device to apply side panels. For example, continuous webs of material **238** used to form the side panels **88** and **90** can be provided from suitable supply sources **240**. The supply sources **240** can include one or more unwind mechanisms. The side panel material **238** can be cut into individual strips **242** and positioned partially on the bodyside liner material **222** using an applicator device **244**. In the cross machine direction, the individual strips **242** suitably extend laterally outward from the bodyside liner material **222** and overlap the bodyside liner material to permit bonding of the strips to the bodyside liner and/or the containment flap material. Bonding may be accomplished using adhesives, as is well known in the art, or by any other bonding means. In the machine direction **226**, the position of the strips **242** can be registered relative to the absorbent assemblies **10** so that the product assemblage **232** can be cut between the absorbent assemblies with each strip **242** of side panel material **238** forming both a front side panel **88** and a back side panel **90** of consecutive garments **60**.

One suitable applicator device **244** is disclosed in U.S. Patents 5,104,116 issued April 14, 1992 and 5,224,405 issued July 6, 1993 both to Pohjola, which are incorporated herein by reference. The applicator device **244** can include a cutting assembly **246** and a rotatable transfer roll **248**. The cutting assembly **246** employs a rotatable knife roll **250** and a rotatable vacuum anvil roll **252** to cut individual strips **242** from the continuous side panel material **238**. The strips **242** cut by a blade on the knife roll **250** can be maintained on the anvil roll **252** by vacuum and transferred to the transfer roll **248**.

The rotatable transfer roll **248** can include a plurality of rotatable vacuum pucks **254**. The vacuum pucks **254** receive the strips **242** of material **238** from the

cutting assembly **246** and rotate and transfer the strips to the continuously moving bodyside liner material **222**. When the strips **242** are positioned as desired relative to the bodyside liner material **222**, the strips are released from the pucks **254** by extinguishing the vacuum in the pucks. The pucks **254** can continue to rotate toward the cutting assembly **246** to receive other strips.

Alternative configurations for attaching the side panel material **238** exist. For instance, the material **238** used to form the side panels can be provided in continuous form and contour cut to form leg openings **78**. Still alternatively, the side panels **88** and **90** of the pant **60** can be provided by portions of the bodyside liner **70** and/or outer cover **72**. It should be noted that the side panel application processes just described are exemplary only, and that the process can vary greatly depending on the physical characteristics of the material and the nature of the process.

A continuous supply of material **256** used to form the outer cover **72** can be provided from a supply roll **258** or other suitable source. As the material is unwound, the outer cover material **256** can be married with the bodyside liner material **222** such as by use of a laminator roll **260**. The absorbent assemblies **10** are thereby sandwiched between the continuous materials **222** and **256**. The inward portions of the strips **242** of side panel material **238** can also be disposed between the bodyside liner material **222** and the outer cover material **256**. Various components such as leg elastics **106** or waist elastics **102** and **104** can be bonded to the outer cover material **256** at an application station **262** prior to uniting the bodyside liner and outer cover materials **222** and **256**. Alternatively, leg elastics or waist elastics can be initially bonded to the bodyside liner material **222** or another material.

The outer cover **256** can be joined to the liner-side panel composite using any means known to those of skill in the art. Where an adhesive is used, the adhesive can be applied on or prior to laminator roll **260**. Alternatively, bonding devices such as ultrasonic or thermal bonders can be employed as part of the laminator roll **260** or at a downstream location **264** to bond the bodyside liner material **222**, side panel material **238** and outer cover material **256**.

The assembly section **220** can include apparatus to provide/apply a fastening system to the garment **60**. For example, the continuously moving

product assemblage next advances to a fastener application station **266** where fastening components **94** and **96** can be bonded to the strips **242** of side panel material **238**. The location of the fastening components on the composite is a function in part of the configuration of the assembly section **220**. The illustrated assembly section **220** is configured so that the upwardly facing surface of the product assemblage **232** will become the outer surface of the pant **60** and the downwardly facing surface will become the inner surface. Moreover, the illustrated assembly section **220** is configured to produce partially assembled garments **60** having the front waist region **64** of a leading garment connected to the back waist region **66** of a trailing garment. The process could alternatively employ any combination of different orientations. For example, the upwardly facing surface of the product assemblage could form the inner surface of finished garments. Additionally or alternatively, the back waist region **66** of a leading garment can be connected to the front waist region **64** of the trailing garment, or the garments can be arranged in a front-to-front/back-to-back relationship. Still alternatively, the assembly section **220** can be constructed as a cross-machine direction process wherein the longitudinal axis of each garment could be perpendicular to the machine direction **226** during part or all of the assembly process.

Continuous webs of a fastener material **278** used to form the fastening components **96** (Figs. 2 and 4) can be provided from supply rolls **280** or other suitable sources. The fastener materials **278** can be cut into individual fasteners **96** by cutting assemblies **282** or other suitable devices. The illustrated cutting assemblies **282** include rotatable knife rolls **284**, rotatable vacuum anvil rolls **286**, and rotatable backing rolls **288**. The continuous fastener materials **278** can be cut by blades on the knife rolls **284**, maintained on the anvil rolls **286** by vacuum, and disposed on the top surfaces of the strips **242** of side panel material **238**.

Similarly, continuous webs of a fastener material **290** used to form the fastening components **94**, shown in Figs. 2 and 4, can be provided from supply rolls **292** or other suitable sources. The first fastener materials **290** can be cut into individual first fasteners **94** by cutting assemblies **294** or other suitable devices.

Alternatively, a component of the garment **60** may serve as the fastening components, in which case some or all of the fastener application station **266** or the cutting assemblies **294** may not be needed. The illustrated cutting assemblies

294 include rotatable knife rolls **296**, rotatable vacuum anvil rolls **298**, and rotatable backing rolls **300**. The continuous fastener materials **290** can be cut by blades on the knife rolls **296**, maintained on the anvil rolls **298** by vacuum, and disposed on the undersides of the strips **242** of side panel material **238**.

Other arrangements can be used to attach the fastening components **94** and **96**. For example, the fastening components can be applied to the side panel material **238** prior to uniting the side panel material with the bodyside liner material **222** and/or the outer cover material **256**; the fastening components can be applied to the bodyside liner material **222** and/or outer cover material **256**, whether separate side panels are used or not; portions of other components such as the bodyside liner and/or outer cover can form one or more of the fastening components; the separate side panels or integral side panels can themselves form one or more of the fastening components; the fastening components can be attached as pre-engaged composites; or the like.

After the fastening components are disposed on the strips **242** of side panel material **238**, bonding devices **302** such as ultrasonic bonders can be employed to bond the fastening components to the strips. For example, the strips **242** can be transported between a rotary ultrasonic horn and an anvil roll, which devices are positioned on each side of the process at the cross machine direction location of the fastening components **94** and **96**. Particular ultrasonic bond patterns including individual, circular bonds which are compatible with mechanical fastening materials are disclosed in U.S. Patent 5,660,666 issued August 26, 1997 to Dilnik et al., which is incorporated herein by reference. Efficient arrangements for attaching the fastening components with nonadhesive bonding devices are further described in U.S. Patent No. 6,562,167, issued May 13, 2003 by J. D. Coenen et al. and titled "Methods For Making Garments With Fastening Components", which is incorporated herein by reference. For secure attachment, it may be desirable to attach the fastening components with both adhesive and thermal bonds. Suitable attachment adhesives are available from commercial vendors such as Findley Adhesive, Inc., Wauwatosa, Wisconsin U.S.A.

In particular embodiments, the bonding devices **302** can provide timed, non-uniform bonding of the fastening components to the side panel material **238**. The degree of bonding, such as the number of bonds per unit area or the bond

strength per unit area, can be greater in certain target areas compared to non-target areas. Enhanced bonding in target areas can be beneficial particularly near the waist and leg openings to reduce or prevent delamination of the fastening components from the side panel material **238**. Thus, the bonding devices **302** can be adapted to create relatively more bonds or stronger bonds between the fastening components and the side panel material **238** when the side panel material **238** reaches a particular machine direction **226** location. In one particular embodiment, the target areas correspond to portions of the fastening components **94** and **96** near the waist edges **80** and **82**. The bonding devices **302** can be registered to provide a relatively higher degree of bonding which begins while disposed on one fastening component, continues through the region where the product assemblage **232** will subsequently be cut, and ends after being disposed on another fastening component. Alternatively, the bonding devices **302** can destroy engaging elements of the fastening components in the target areas, so that the fastening components will be less able to aggressively attach to one another in the target areas.

The strips **242** of side panel material **238** can be trimmed if desired, for example to provide angled and/or curved leg end edges in the back and/or front waist regions. To this end, the assembly section **220** can include a die cutting roll **304** and a backing roll **306**. In the illustrated embodiment, a portion of each strip **242** is trimmed from a trailing edge in order to form the angled and/or curved leg end edges in the back waist region.

The method and apparatus to this point provides a continuous web of interconnected and partially assembled pants moving in the direction indicated by arrow **226**. This continuously moving product assemblage **232** is passed through a cutter **308** which selectively cuts the web into discrete, partially assembled garments **60**. Such cutters **308** are generally known to those skilled in the art and can include, for example, the combination of a cutting roll **310** and an anvil roll **312** through which the web travels. The anvil roll **312** can include a hardened steel rotating roll while the cutting roll **310** can include one or more flexible hardened steel blades clamped onto another rotating roll. The pinching force between the blade on the cutting roll **310** and the anvil roll **312** creates the cut. The cutting roll **310** can have one or more blades depending upon the desired distance between

the cuts. The cutter **308** can further be configured to provide a spacing between the individual cut pieces after they are cut. Such a spacing can be provided by transferring the cut pieces away from the cutter at a higher speed than the speed at which the web is provided to the cutter.

The discrete garments **60** can then be folded and packaged as desired.

It should be understood that the absorbent structure **10** as shown in Fig. 5 and the absorbent structure **50** as shown in Fig. 9 represent exemplary embodiments of absorbent structures that may be made in accordance with the present invention and incorporated into a garment **60**. The teachings and principles of the present invention may be used to form many different absorbent structures in many different configurations.

For example, referring to Fig. 18, another embodiment of an absorbent structure **320** made in accordance with the present invention is shown. As illustrated, the absorbent structure **320** includes a front portion **330**, a middle portion **332**, and a rear portion **334**. In this embodiment, the rear portion **334** is narrower than the front portion **330**.

A blank generally **336** is shown in Fig. 17 which may be used to form the absorbent structure **320**. As shown, the blank **336** includes a pair of score lines **338** and **340** which define lateral flaps **342** and **344**. The blank **336** further includes a pair of middle openings **346** and **348** and a pair of rear openings **350** and **352**. The rear openings **350** and **352** are interconnected to the middle openings **346** and **348**. Further, the rear openings **350** and **352** are separated by a strip of material **354**. The strip of material **354** is for providing integrity to the blank when present in a continuous supply of material containing a succession of repeating blanks **336**.

When the lateral flaps **342** and **344** are folded as shown in Fig. 18, the front portion **330** and the middle portion **332** each have a basis weight that is at least about twice the basis weight of most of the rear portion **334**.

Referring to Fig. 19, a forming drum **122** is shown having a forming surface **124** that may be used to form the blank **336** as shown in Fig. 17. In particular, attached to the forming surface **124** are a pair of masking members **326** and **328** which form the middle openings **346** and **348** and the rear openings **350** and **352** as shown in Fig. 17.

These and other modifications and variations to the present invention may be practiced by those of ordinary skill in the art, without departing from the spirit and scope of the present invention, which is more particularly set forth in the appended claims. In addition, it should be understood that aspects of the various embodiments may be interchanged both in whole or in part. Furthermore, those of ordinary skill in the art will appreciate that the foregoing description is by way of example only, and is not intended to limit the invention so further described in such appended claims.